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NATIONAL DAM SAFETY PROGRAM. LAKE GILMAN DAM (NJ00431), DELAWAR--ETC(U)
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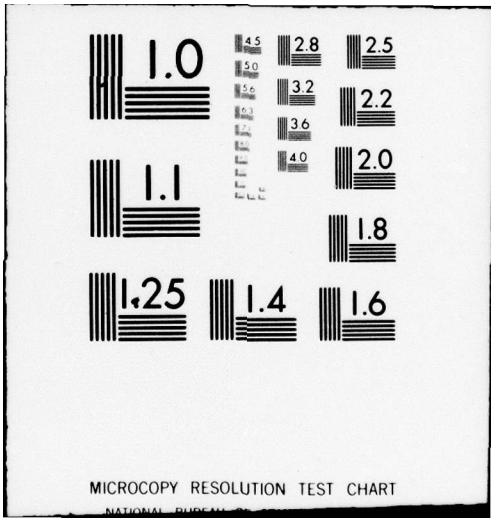
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RACCOON CREEK, GLOUCESTER COUNTY
NEW JERSEY

LEVEL II

LAKE GILMAN DAM
NJ00431

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

August 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

National Dam Safety Program. Lake Gilman Dam (NJ 00431), Delaware River Basin, Raccoon Creek, Gloucester County, New Jersey. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Lake Gilman Dam, N.J.	Visual Inspection
Dams	Spillways
Structural Analysis	Embankments
Safety	National Dam Inspection Act Report

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT. CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA. PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

27 SEP 1979

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Gilman Lake Dam in Gloucester County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Gilman Lake Dam, a high hazard potential structure, is judged to be in good overall condition. The dam's spillway is considered inadequate since seven percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood). The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. The following remedial actions should be completed within one year from the date of approval of this report:

(1). The embankment areas at the ends of all the bridge wingwalls should be regraded and protected with concrete or asphalt slope protection.

(2). Inspect the weathered surface along the top of the spillway wall and patch with epoxy resin.

(3). Construct curbs and catch basins along the roadway gutters to better channelize the roadway runoff.

(4). Remove all trees and brush from the embankment and establish a suitable ground cover.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman James J. Florio of the First District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-D
Honorable Brendan T. Byrne

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

James G. Ton

1 Incl
As stated

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

GILMAN LAKE DAM (NJ00431)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 9 May 1979 by Louis Berger and Associates, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Gilman Lake Dam, a high hazard potential structure, is judged to be in good overall condition. The dam's spillway is considered inadequate since seven percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood). The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. The following remedial actions should be completed within one year from the date of approval of this report:

(1). The embankment areas at the ends of all the bridge wingwalls should be regraded and protected with concrete or asphalt slope protection.

(2). Inspect the weathered surface along the top of the spillway wall and patch with epoxy resin.

(3). Construct curbs and catch basins along the roadway gutters to better channelize the roadway runoff.

(4). Remove all trees and brush from the embankment and establish a suitable ground cover.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 27 Sep 79

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Gilman Lake Dam Fed ID# NJ 00431
and NJ ID# 362

State Located New Jersey
County Located Gloucester
Coordinates Lat. 3941.1 - Long. 7511.1
Stream Raccoon Creek
Date of Inspection 9 May 1979

ASSESSMENT OF GENERAL CONDITIONS

Gilman Lake Dam is assessed to be in a good overall condition although additional hydrologic/hydraulic studies should be undertaken in the future to ascertain what improvements can be made to the inadequate spillway. The roadway embankment portion of the dam is of minor concern and the spillway culvert is believed to be in an adequate structural condition. Remedial actions to be undertaken in the future include 1) protect the earth slopes along the downstream wingwalls with additional slope paving, 2) inspect and repair the top of the spillway wall, 3) construct curbs and catch basins along the roadway gutters and remove all dead trees and root systems from the embankment.

The capacity of the spillway will accommodate only 6% of the design flood and is assessed as inadequate but the dam is not classified as UNSAFE, NON-EMERGENCY as it does

not comply with the provisions of ETL 1110-2-234 in that failure from overtopping would not significantly increase the hazard to loss of life downstream from that which would exist just before overtopping failure.

F. Keith Jolls, P.E.
Project Manager

OVERVIEW OF LAKE GILMAN DAM

MAY, 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: LAKE GILMAN DAM FED ID# NJ 00431
NJ ID# 362

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Engineer District, Philadelphia, to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Lake Gilman Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Lake Gilman Dam is a roadway embankment structure 350 feet in length with a bridged spillway. The asphalt-paved Ellis Mill Road, approximately 30 feet wide, runs along the crest of the dam. The spillway is a concrete three-sided drop inlet structure with a 4 foot wide steel lift gate in the front section. The dam has a maximum height of 14 feet and 2H:1V side slopes except for a portion along the upstream face where a timber bulkhead is constructed.

b. Location

Lake Gilman Dam is located in Harrison and Elk Townships, Gloucester County, New Jersey. The corporate boundary bisects the spillway bridge. The dam lies on Ellis Mill Road approximately two tenths of a mile southwest of its intersection with the Ewan-Aura Road.

c. Size Classification

The maximum height of the dam is approximately 14 feet and the maximum storage is 154 acre-feet. Therefore the dam is placed in the small size category as defined by the Recommended Guidelines for Safety Inspection of Dams (total impoundment less than 1,000 acre-feet).

d. Hazard Classification

Based on Corps of Engineers criteria and the fact that in the event of a failure, severe damage could occur to several downstream properties together with a potential for loss of more than a few lives, the dam is classified as a high hazard. Immediately below the dam lie at least three houses which would be directly in the path of any flood. Further, about 5,000 feet downstream is the dam at Ewan Lake which has failed in the past (when the study dam failed) and remains in a hazardous position should the study dam again collapse.

e. Ownership

The roadway embankment and spillway discharge culvert are the property of Gloucester County Road Department. However, the original 1928 dam application permit was filed by a Mr. Miles Gilman and subsequent repairs and installation of the existing gate have been undertaken by Lake Gilman Inc., the community assocation who own and maintain the lake. This corporation may own all or part of the spillway. The exact position of the edge of County Right-of-Way could not be determined. Thus, it appears there is joint ownership but the sharing of responsibility is not clear.

f. Purpose of Dam

The dam impounds an artificial lake which is used solely for recreation purposes.

g. Design and Construction History

Little is known of the dam's early history. However, the embankment and arch culvert appear to have been constructed in 1927 and the spillway installed in 1928. The spillway was designed by E. Stultz Pierce, P.E. of Glassboro. Mr. Gilman originally established the lake as a private summer vacation facility but eventually sold off building lots to private individuals who now form the membership of the Association. On September 1, 1940, a 50 foot section of the dam was washed out and immediately repaired by J.R. Williams, General Contractor. In 1968, the two part steel liftgate was installed in the spillway wall, replacing earlier timber stoplogs.

h. Normal Operating Procedures

The spillway is operated and maintained by the Lake Gilman Inc. Association. The lake is lowered several feet every spring to facilitate inspection and repair (see Section 4).

1.3 PERTINENT DATA

a. Drainage Area

The drainage area for Lake Gilman Dam is 4.0 square miles.

b. Discharge of Damsite

Spillway capacity at maximum pool (top of dam) elevation - 786 cfs

c. Elevation (Ft. above MSL)

Top of dam (max. pool) - 93.0
Recreation pool (spillway crest) - 89.0
Streambed at centerline of dam - 81± (paved invert)

d. Reservoir

Length of maximum pool - 2,500 feet
Length of recreation pool - 2,000 feet

e. Storage (acre-feet)

Maximum pool (top of dam) - 154
Recreation pool - 75

f. Reservoir Surface (acres)

Maximum pool - 26.75
Recreation pool - 12.5

g. Dam

Type - earth embankment with concrete spillway
Length - 350 feet
Height - 14 feet
Top width - 40 feet (varies)
Side slopes - 2H:1V (varies)
Zoning and core - unknown

h. Diversion and Regulating Tunnel - None

i. Spillway

Type - three-sided narrow crested weir;
length - 34 feet (Effective length - 32 feet)
Crest elevation - +89.0
U/S channel - main reservoir
D/S channel - Raccoon Creek natural channel

j. Regulating Outlets

Type - 4' wide x 8' high vertical-lift steel sluicegate

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The only design plans available were for the 1940 re-construction which were prepared by Mr. J.R. Williams. These indicated the overall height and geometry of the embankment and the extent of the stone slope protection. It appears from old photographs that about 50 feet of the embankment was washed out in the 1940 flood but the spillway was not damaged. According to Division of Water Resources records, the concrete inlet and culvert are surrounded by a timber cofferdam. No design analyses or records of any subsurface investigations were located. The predominant soils in the vicinity are composed of recent alluvium sands and silts with discontinuous, intermingled layers of clay and considerable amounts of organic material. The alluvium overlies swampy deposits which are generally encountered at depths less than ten feet. Below this are Cohansey, Kirkwood and Pennsauken sands, extending down to bedrock. Drainage of the foundation soils is usually poor and the depth to bedrock is greater than 50 feet.

The reinforced concrete arch culvert is typical of the type designed by Mr. William Cattell, the County Engineer, in the 1920's and 30's and bears the County identification No. 7-H-4. Because no plans were available, it could not be determined whether or not it is built on timber piling although at most sites throughout the county, this is generally the case for work of this era.

2.2 CONSTRUCTION

No data was located regarding who accomplished the initial construction or what records were kept. As the spillway portion of the dam has always been in private ownership, it is doubtful if any additional records are readily available other than those at the Division of Water Resources. Gloucester County officials state that they do not have records of their culvert construction.

2.3 OPERATION

The dam has operated as an uncontrolled overflow facility but with frequent regulation of the lake level by use of the 4 foot wide sluice gate (see Section 4).

2.4 EVALUATION

a. Availability

In the opinion of the inspection team, sufficient engineering data is available to determine the structural adequacy of the concrete spillway and outlet culvert although no meaningful design computations were located. No data was acquired upon which to base an assessment with regards to the embankment composition or zoning. However, except for the zone immediately to the right of the spillway, this is not particularly relevant as the embankment is extremely wide in relation to its height.

b. Adequacy

The engineering data relating to the spillway is regarded as sufficiently adequate to render the following assessment without recourse to gathering further information.

c. Validity

The validity of the spillway data is not challenged as the inspection revealed it exists substantially as designed.

SECTION 3 - VISUAL OBSERVATIONS

3.1 a. General

The visual inspection was conducted on 9 May 1979 and revealed a stable condition with the reservoir level maintained approximately two feet below normal pool. There appeared to be considerable leakage around the sides of the steel sluicegate in the spillway crestwall and a sizeable discharge passing through the bridged outlet. Earlier inspections revealed the lake level at the top of the spillway crestwall and discharging about 2 inches over the weir. Except as noted below, the overall condition is well-maintained.

b. Dam

The roadway embankment which forms the earth portion of the dam was found to be in a stable condition. The low point of the sag vertical curve of the road profile is located to the right of the spillway and it was noted that any flows over the crest would be concentrated in this area. Proceeding towards each abutment zone, the crest rises approximately two feet. The roadway is asphalt paved and is in good condition although the shoulders are eroded and sloughed off near the edges. The sideslopes are irregular and there is severe erosion at the right downstream wingwall of the culvert. There is a substantial amount of broken concrete riprap placed along the upstream face and a low timber bulkhead constructed near the left end of the dam along the upstream shoulder. There are several 2 to 8 inch trees and brush with a chainlink fence installed across the dam (see appended photographs). There are several larger trees on the downstream slopes. Much of the sideslope erosion is due to run-off from the roadway pavement but an 18-inch drain has been placed at the left downstream wingwall to prevent further erosion in this area. The downstream slopes are not well maintained. Some seepage was observed in a ditch which is ten feet beyond the downstream toe to the right of the culvert.

This ditch roughly parallels the toe of slope. It could not be determined whether or not this was the result of the natural water table or overland flow from the right.

c. Appurtenant Structures

The reinforced concrete arch culvert is in excellent structural condition in view of its age. The wingwalls and parapets display minor cracking and spalled areas but the structurally important zones are in an integral condition. The semi-circular culvert opening has a clear span of 20 feet. The headroom above the paved invert is about 8 feet and there is a two to three foot drop at the outlet edge onto the natural stream bed. The spillway drop inlet is a three-sided reinforced concrete wall connected to the bridge wingwalls. The middle section is 10 feet wide with each flared side measuring 12 feet. The top of the weir is spalled and considerably weathered but is in an integral condition. The vertical-lift steel sluicegate is serviced from a small concrete platform which extends out from the culvert fascia. The gate is divided into two sections and is fabricated from ½ inch steel plate. It is mounted on a steel frame comprised of 3 inch ship channels with a top frame to support a come-a-long for emergency lifting or removal. Although the gate was submerged it appears to be approximately 4 feet wide and 8 feet deep and is operable. There is no evidence of any other emergency outlet. A small gate in the chain-link fence limits vandalism to the sluicegate.

d. Reservoir Area

Gilman Lake has a regular, well-defined shoreline that extends upstream in two rather wide coves. The reservoir is almost entirely bounded with residential development and is clear of debris. There is little evidence of silting except immediately adjacent to the dam face. There are numerous bathing facilities and low sea walls along the shoreline and a beach area has been erected just above the left abutment.

e. Downstream Channel

After discharging through the study dam, Raccoon Creek flows 2,000 feet northwest into the head waters of Ewan Lake. The channel is narrow but well-defined and the overbank flood zones are heavily wooded.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures were not physically observed by the inspection team. Discussions were held with personnel of the Gloucester County Road Department who handle the regular maintenance of the culvert and crest roadway and with members of the lake club who maintain the spillway.

4.2 MAINTENANCE OF DAM

The box culvert is maintained by Gloucester County in a workmanlike fashion as part of their continual road program. The spillway, chain-link fence and upstream shorelines are maintained by the lake club.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only operating facility is the steel sluicegate which is operated and maintained by the lake club. Their representatives stated that repairs are undertaken yearly when the lake level is lowered.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

None exists except for monitoring by County and local Municipal personnel during heavy storms. Members of the lake club adjust the sluicegate during heavy storms to prevent flooding of the low-lying residences around the lake.

4.5 EVALUATION

The present operations are deemed to be adequate in view of the height of the dam and the fact that there is no record of overtopping since 1940. The upkeep of the spillway and shorefront along the upstream face is satisfactory and silt is periodically removed by private contract when the lake is lowered each spring. As previously stated, the maintanence of the downstream embankment slopes appears to have been neglected in recent years.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based on the criteria in the Recommended Guidelines for Safety Inspection of Dams, Gilman Lake Dam is small in size but is placed in the high hazard category. One half the probable maximum flood was selected as the design storm by the inspecting engineers. Precipitation data was obtained from Hydrometeorological Report #33. The routed outflow from Wrights Mill Pond (3,788 cfs) was included in the inflow to the lake (Wrights Mill Pond lies immediately upstream on one of the tributaries which feed Lake Gilman). Inflow also included that due to the intermediate area between the upper reservoir and Lake Gilman. The inflow hydrograph and reservoir routing were calculated utilizing the HEC-1 computer program. This gave a peak inflow to the reservoir of 14,270 cfs which routing reduced to 13,825 cfs. The spillway capacity before overtopping is approximately 790 cfs and can accommodate only 6% of the design flood and is adjudged to be "inadequate" (see Section 7).

b. Experience Data

Records indicate that a 50 foot section of the dam was washed out in a storm on September 1, 1940. Since then, however, an inspection report (filed in 1970) indicates that there has been no overtopping since the dam was repaired after the storm in 1940.

c. Visual Observations

According to the 1970 report, a severe storm in 1967 did not overtop the dam and the flow was controlled by opening the gate. It was noted that with the sluicegate open, the spillway capacity is increased by approximately 70%. These facts were confirmed by the lake club representatives.

d. Overtopping Potential

The hydraulic analysis indicates a considerable potential for overtopping exists due to the small capacity of the spillway. The design flood would overtop the top of dam by about 5.5 feet.

e. Drawdown

Drawdown is provided by the 4 foot wide vertical-lift sluicegate. Assuming no tailwater or inflow to the reservoir, it would take approximately three quarters of a day to drawdown the reservoir from the recreation pool elevation down to El. 81±. No further drawdown is possible. The lake club only employs one leaf of the sluiceway so the actual drawdown time achieved during normal operation is considerably longer.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Based upon the inspection of existing conditions and the single source of design plans, the dam embankment and roadway culvert are deemed to be in a good to excellent condition except for the continual maintenance problem of roadway surface drainage at the ends of the wingwalls. Although no serious hazard is foreseen, a collapse of the spillway could choke up the culvert opening and create a hydraulic blockage which would be difficult to clear during periods of heavy flow. The top of the weir is weathered and because it was partially submerged, was not visible for close inspection. The roadway embankment is quite wide in relation to its height and as a water-impounding structure, has adequate stability although the dead trees and root systems should be removed. Further, the timber sheet piling cofferdam around the culvert foundations contribute to an increased length of flow network in the rather abbreviated length of higher embankment each side of the spillway. Overtopping could cause a wash-out of the downstream road shoulders and sideslopes along the culvert wingwall on the right, albeit the crest is paved with asphaltic concrete. Because of the sag curve in the road profile, the overflow would be concentrated in a single area to the right of the spillway and could possible cause a breaching, similar to that which previously occurred in this zone.

b. Design and Construction Data

Although no hydraulic or structural computations were located, a review of the original plans indicates that the concrete intake structure and arch culvert were conservatively designed and in spite of their age, are believed to be adequate insofar as stability and strength are concerned.

c. Operating Records

No records are available but the dam appears to be operating satisfactorily. There are no known instances since 1940 where overtopping caused any appreciable damage and the 1967 flood was contained by the spillway (with the gate open).

d. Post Construction Changes

The only post-construction changes in evidence is the 1968 installation of the steel gate. However, there has been a variety of drainage control devices installed along the road shoulders to channelize the surface run-off (which appears to be a continual maintenance problem).

e. Seismic Stability

The dam is located in Seismic Zone 1 and due to its embankment width and spillway geometry, has negligible vulnerability regarding earthquake loading intensities. Experience of the consultant indicates that dams in Zone 1 will have adequate stability under dynamic loadings if stable under static loading conditions.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/ PROPOSED REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

Subject to the inherent limitations of the Phase I visual inspection, the Lake Gilman Dam is classified as being in a sound and satisfactory structural condition although the spillway overflow weir and discharge culvert are incapable of passing the design flood. The dam embankment is built of unknown composition but due to its low height, broad width, and timber cut-off walls, is felt to be of a sufficient impervious condition to withstand all normally anticipated hydraulic heads. The present spillway capacity is inadequate and does not meet the requirements of the Recommended Guidelines for Safety Inspection of Dams, being able to accommodate only 6% of the ½ PMP design flood as calculated by Corps of Engineers criteria. The SDF is calculated to overtop the dam by 5.5 feet at the low point along the roadway. Such an overtopping could cause serious erosion and conceivably breach the embankment.

b. Adequacy of Information

The information gathered for the Phase I inspection is deemed to be adequate regarding the structural stability of the dam. However, no recent surveys or inspections have been made since 1968.

c. Urgency

It is recommended that further studies and the remedial measures enumerated below be undertaken in the future.

d. Necessity for Further Study

In view of the inability to discharge the anticipated design flow, further hydraulic and hydrologic studies are recommended to ascertain what

feasible methods might be employed to alleviate the substandard hydraulic condition. The present spillway is not adjudged to be "seriously inadequate" as the overall conditions do not comply with the Federal requirements of ETL 1110-2-234 and the dam is not classified "UNSAFE, NON-EMERGENCY". Failure from overtopping would not significantly increase the downstream hazard to human life. The close proximity of the dwellings would unquestionably tend to allow the evacuation of these downstream dwellings prior to any period where an overtopping might conceivably occur at the study dam.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

a. Recommendations

Based on the results of further engineering studies, the downstream face of the embankment at the extreme low point in the roadway profile could be further protected with slope paving and in effect, act as an auxiliary spillway. The embankment areas at the ends of all the bridge wingwalls should be regraded and protected with concrete or asphalt slope protection. Other remedial measures to be taken under advisement include:

1) Further inspect and patch with epoxy resin the weathered surfaces along the top of the spillway wall.

2) Construct curbs and catch basins along the roadway gutters to better channelize the roadway run-off.

3) Remove all dead trees and roots systems from the embankment.

b. O&M Maintenance and Procedures

No additional procedures other than those presently in effect appear to be warranted until such time as further studies are completed. The Lake Gilman Inc. association is cognizant of their responsibilities and appear to do an excellent job in fulfilling their duties.

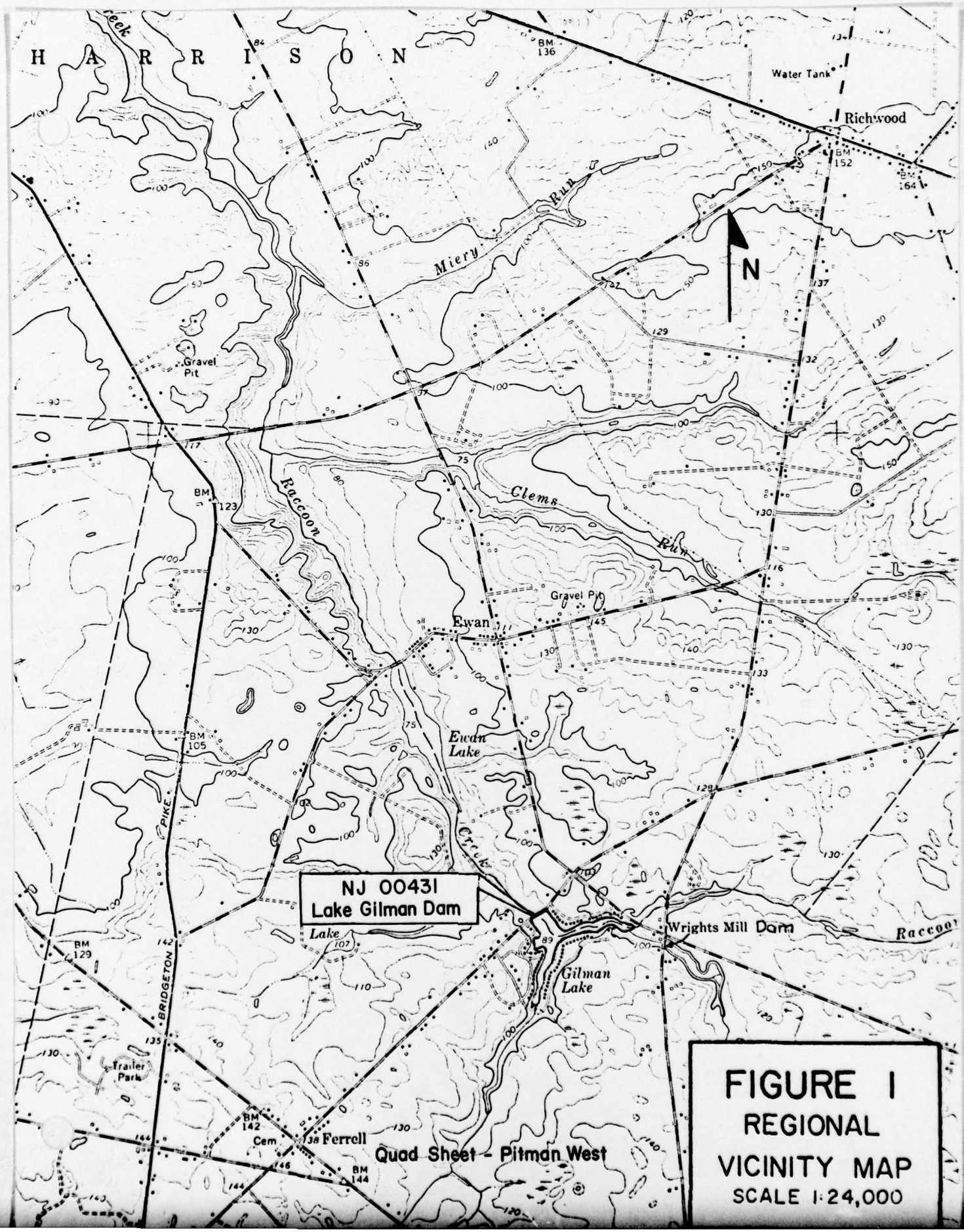
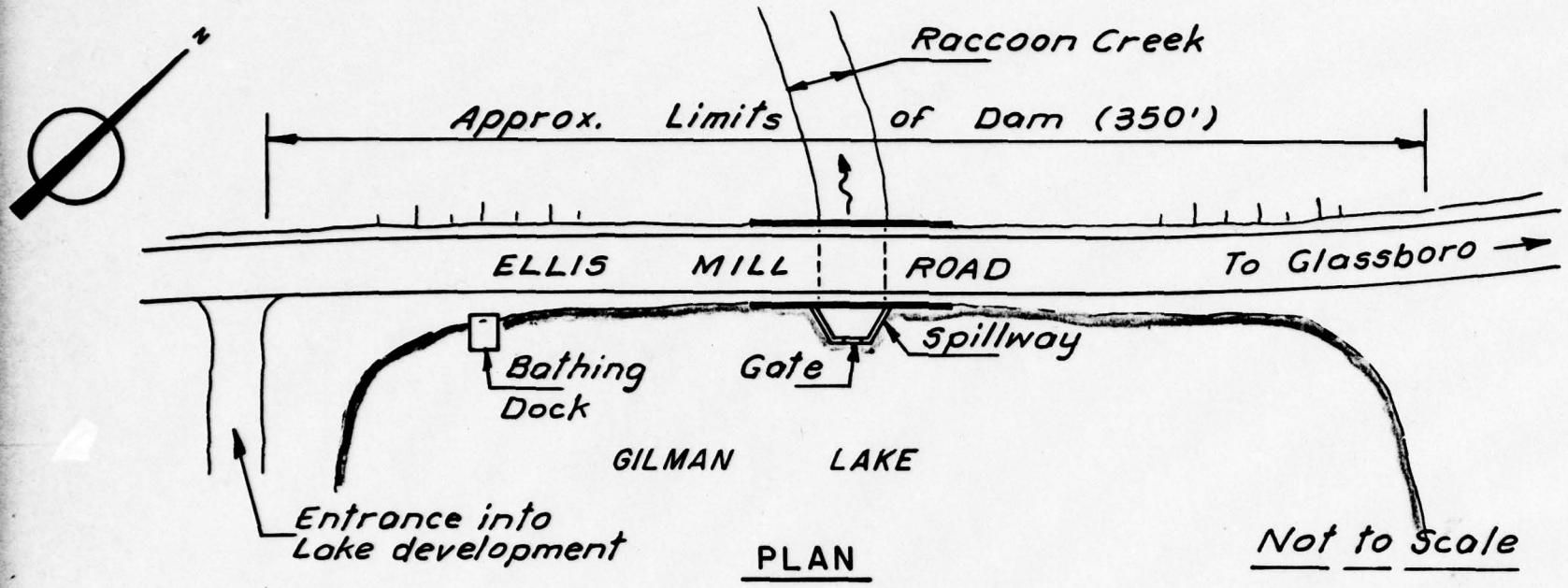
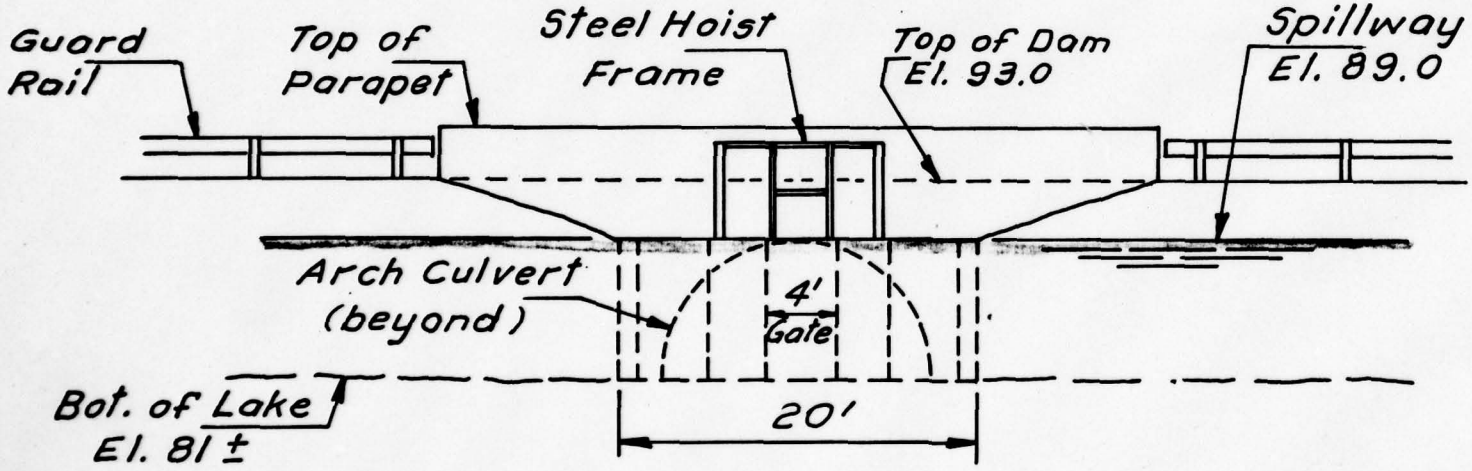


FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24,000



PLAN



INLET ELEVATION

FIGURE 2

Check List
Visual Inspection
Phase 1

Name Dam Lake Gilman County Gloucester State New Jersey Coordinators NJDEP

Date(s) Inspection 9 May '79 Weather Clear Temperature 85°

Pool Elevation at Time of Inspection 89.25 M.S.L. Tailwater at Time of Inspection _____ M.S.L.

Inspection Personnel:

K. Jolls

L. Baines

K. Greenfield

K. Jolls Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	2-lane asphalt roadway.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	Deeply incised ditch just below bridge (on right side). Caused by discharge from roadway curb inlet. (Undercutting toe of embankment).
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Upstream areas protected by timber bulkheads at left of spillway.	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Satisfactory. Roadway quite level. Low point in profile occurs just to right of spillway.	Length of dam $\cong$ width of pond at dam face.
RIPRAP FAILURES	No riprap except for some broken concrete slabs placed on front slopes.	Severe erosion on right downstream wingwall.

EMBANKMENT

SUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
xcessive shrub growth, rees, etc.	Several large trees to each side of roadway. Some secondary growth.	Chain link fence all across face of dam; would collect all debris if dam were over-topped.
NCTION OF EMBANKMENT D ABUTMENT, SPILLWAY D DAM	Satisfactory.	
Y NOTICEABLE SEEPAGE	None observed.	
AFF GAGE AND RECORDER	None observed.	
AINS	None except roadway surface inlets.	Several roadway ditches are plugged up.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	3-sided weir with gate on front. 4'-wide vertical lift sluicegate at bottom of weir. Drop = 10'	Chain hoists in position. Condition: Operable.
APPROACH CHANNEL	Main lake reservoir. Surrounding houses low-at approx. top of dam elevation.	
DISCHARGE CHANNEL	Natural river channel.	
BRIDGE AND PIERS	Old county bridge (circular box culvert). Condition satisfactory. No major structural cracking observed. Paved invert slab to south fascia.	County Bridge #7-H-4 (1925) William C. Cattell, CE Just Eriksen, Contractor

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Bathing facilities on left shore about 80' east of dam abutment.	
SEDIMENTATION	Minor sedimentation observed at dam face.	
	Lake Gilman Associates - owner.	

(2)

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Natural channel - clear Approximate width = 40'	
SLOPES	Steep natural banks. Heavily wooded.	
APPROXIMATE NO. OF HOMES AND POPULATION	Houses immediately downstream - only 5'-6' above stream channel invert.	Recommend high hazard (2 to 4 homes).

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not available.
REGIONAL VICINITY MAP	Available (U.S.G.S. Quad - Pitman West)
CONSTRUCTION HISTORY	Some available (NJDEP).
TYPICAL SECTIONS OF DAM	None available.
HYDROLOGIC/HYDRAULIC DATA	None available.
OUTLETS - PLAN	Not available.
- DETAILS	Not available.
-CONSTRAINTS	Not available.
-DISCHARGE RATINGS	Not available.
RAINFALL/RESERVOIR RECORDS	Not available.

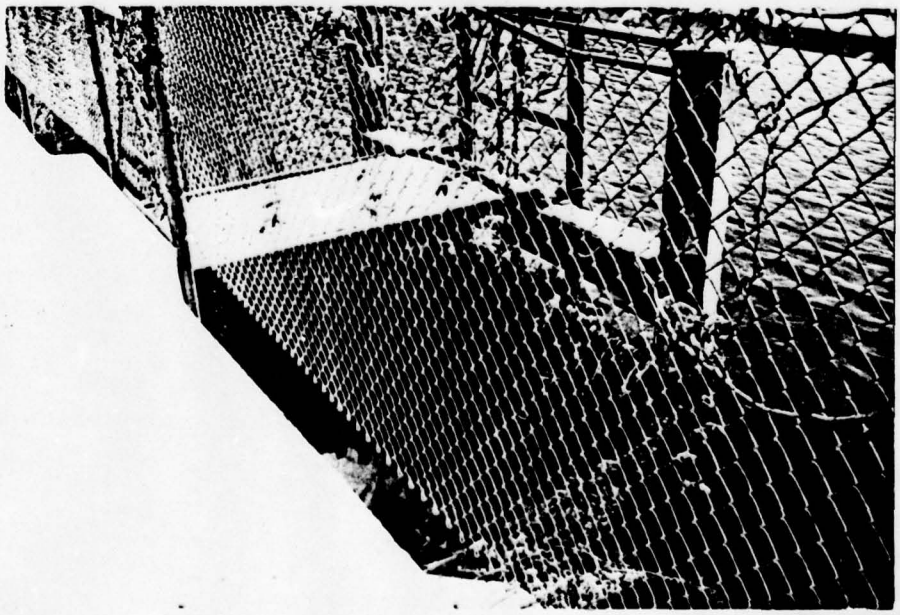
ITEM	REMARKS
SPILLWAY PLAN	Not available.
SECTIONS	Not available.
DETAILS	Not available.
OPERATING EQUIPMENT PLANS & DETAILS	Not available.

ITEM	REMARKS
DESIGN REPORTS	Not available.
GEOLOGY REPORTS	Not available.
DESIGN COMPUTATIONS	Not available.
HYDROLOGY & HYDRAULICS	Not available.
DAM STABILITY	Not available.
SEEPAGE STUDIES	Not available.
MATERIALS INVESTIGATIONS	Not available.
BORING RECORDS	Not available.
LABORATORY	Not available.
FIELD	Not available.
POST-CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	None available.
MODIFICATIONS	None.
HIGH POOL RECORDS	None available.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	September 1, 1940 Limited amount available (NJDEP records)
MAINTENANCE OPERATION RECORDS	None available.

May, 1979

VIEW OF SPILLWAY



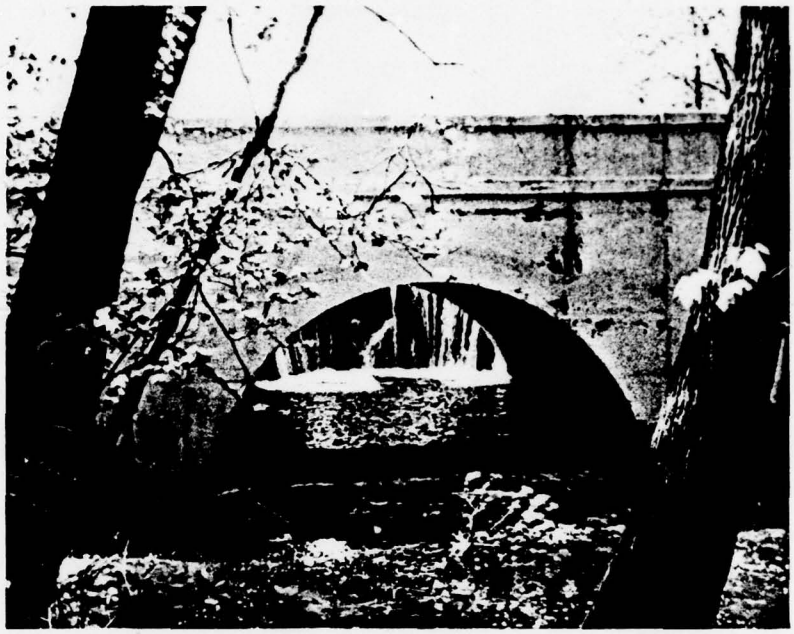
May, 1979

May, 1979

View of Crest Looking Northeast

May, 1979

View of House Immediately Downstream of Dam



May, 1979

View of Spillway Outlet

May, 1979

View of Ditch at Right Downstream Toe of Dam

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 4.0 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 89.0 MSL (75 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 93.0 MSL (154 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 93.0 MSL

CREST:

a. Elevation 93 MSL
b. Type Earth embankment with concrete spillway (see below)
c. Width 40 feet
d. Length 350 feet
e. Location Spillover central portion of dam embankment
f. Number and Type of Gates None

OUTLET WORKS: Concrete Spillway

a. Type Three-sided narrow crested weir
b. Location central portion of dam embankment
c. Entrance inverts 89 MSL
d. Exit inverts 81 MSL (paved invert)
e. Emergency draindown facilities 4' wide x 8' high vertical lift sluice

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 786 cfs

BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A1 OF
CHKD. BY ____ DATE ____ LAKE GILMAN DAM PROJECT C.234
SUBJECT ____

Time of concentration :

length along watercourse to drainage divide = 1.4 miles
= 7392 feet

$\Delta H = 50'$ ∴ Slope $= \frac{50 \times 100}{7392} = 0.7\%$

Assume velocity of 2 feet s^{-1}

gives $t_c = \frac{7392}{2 \times 3600} \simeq 1$ hour

By California Culverts Method :

gives $t_c = \left(\frac{11.9 \times 1.4^3}{50}\right)^{0.385} = 0.85$ hours

Another alternate method :

$t_c = \frac{L^{1.15}}{7700\, H^{0.38}} = \frac{7392^{1.15}}{7700 \times 50^{0.38}}$

$= 0.83$ hours

Use average $t_c = (0.83 + 0.85 + 1)/3 = 0.89$ hours

$t_p = \frac{0.25}{2} + 0.6 \times 0.89 = 0.67$ hours

$Q_p = \frac{484 \times 2.3}{0.67} = 1673$ cfs

BY D.J.M. DATE 6-79 | **LOUIS BERGER & ASSOCIATES INC.** | SHEET NO. A2 OF

CHKD. BY ____ DATE ____ | LAKE GILMAN DAM | PROJECT C.234

SUBJECT ____

UNITGRAPH :

Time (hours)	T/Tp	Dimensionless Ordinate (DO)	Q (cfs) = Qp x DO
0.25	0.38	0.25	418
0.50	0.75	0.83	1389
0.75	1.13	0.96	1607
1.00	1.50	0.66	1104
1.25	1.88	0.38	636
1.50	2.25	0.22	368
1.75	2.63	0.12	201
2.00	3.01	0.07	117
2.25	3.38	0.04	67
2.50	3.76	0.026	44

PRECIPITATION :

Probable Maximum Precipitation for 200 square miles - 24 hours (in inches) = 23.8"

Maximum 6 hour percentage = 113 %

Maximum 12 hour percentage = 123 %

Maximum 24 hour percentage = 132 %

BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A3 OF

CHKD. BY ____ DATE ____ LAKE GILMAN DAM PROJECT C234

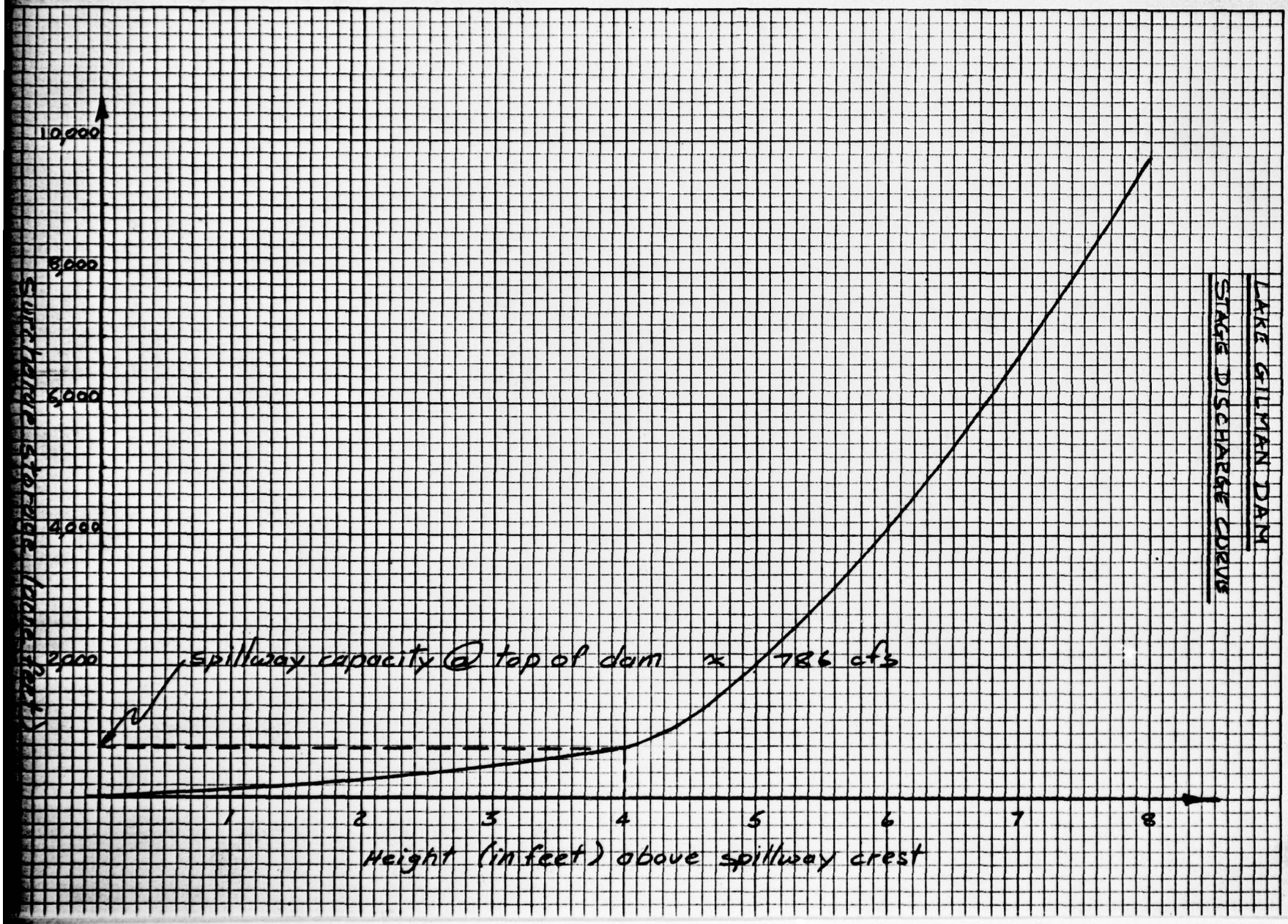
SUBJECT Spillway discharge capacity

Spillway discharge:

flow over crest front L = 10'			flow over sides Effective L = 22'			flow over dam L = 350'		
H	C	Q	H	C	Q	H	C	Q
0			0					
1	3.1	31	1	3.1	68			
2	3.1	88	2	3.1	193			
3	3.0	156	3	3.1	354			
4	3.0	240	4	3.1	546	0	2.7	0
5	2.9	324	5	3.1	762	1	2.7	945
6	2.9	426	6	3.1	1002	2	2.7	2673
7	2.9	537	7	3.1	1263	3	2.7	4910
8	2.9	656	8	3.1	1543	4	2.7	7560

H in feet above spillway crest	Σ Q (cfs)
0	0
1	99
2	281
3	510
4	786
5	2031
6	4101
7	6710
8	9759

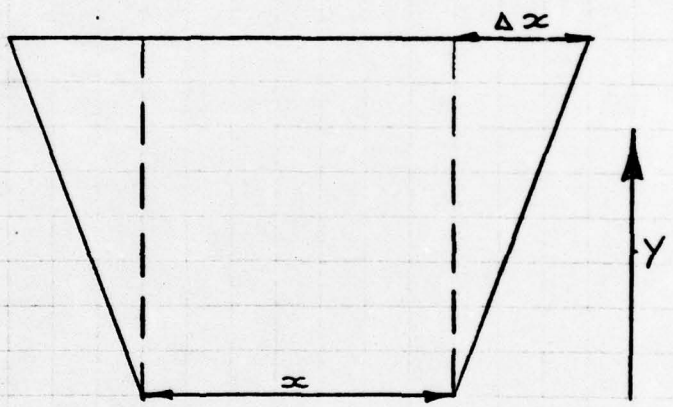
NOTE: The spillway is a drop inlet structure open on three sides. However the front has a gate structure which would reduce the hydraulic capacity as the water rises, thus the coeficient of discharge is reduced in the above calculation.



BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A-5 OF
CHKD. BY _____ DATE _____ LAKE GILMAN DAM PROJECT C234
SUBJECT _____

SURCHARGE STORAGE :

Area of lake @ normal pool = 12.5 acres
Area of lake @ top of dam =
Area of 100' contour = 51.7 acres



Increment in volume $\Delta V = (x + \Delta x) Y$

Height in feet above spillway crest.	Surcharge storage (acre feet)
0	0
1	14
2	32
3	54
4	79
5	107
6	139
7	175
8	214

A6

LAKE GILMAN DAM

STAGE STORAGE CURVE

BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A-7 OF
CHKD. BY DATE LAKE GILMAN DAM PROJECT C-234
SUBJECT

GENERAL SUMMARY OF APPENDIX:

length of dam = 350 feet
Effective length of spillway = 32'

Spillway capacity @ top of dam = 786 cfs

Surcharge storage @ top of dam = 79 acre feet
normal pool storage = 75 acre feet

∴ Total storage @ top of dam = 154 acre feet

Area of lake @ normal pool = 12.5 acres
Area of lake @ top of dam = 26.75 acres

Drainage area = 2.3 square miles

BY D.J.M. DATE 7-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A-8 OF.

CHKD. BY ____ DATE ____ LAKE GILMAN DAM PROJECT C254

SUBJECT Approximate drawdown calculations

Available head = 8'

Storage @ normal pool = 75 acre feet

Assume drawdown in 2 stages with no inflow and no tailwater

Stage 1)

$H = 6'$

$Q \approx 6^{1.5} \times 3.1 \times 4 = 182 \text{ cfs}$

$\therefore$ time $= \dfrac{75 \times 43560}{2 \times 182 \times 3600}$

$= 2.49$ hours

Stage 2)

$H = 2'$

$Q = 2^{1.5} \times 3.1 \times 4 = 35 \text{ cfs}$

$\therefore$ time $= \dfrac{75 \times 43560}{2 \times 35 \times 3600}$

$= 12.94$ hours

Σ time $= 12.94 + 2.5 \approx 15.4$ hours

Say 3/4 day

WRIGHTS MILL&GILMAN LAKE DAMS (WRIGHTS MILL UPSTREAM FROM GILMAN)
BY D.J.M.
JUNE 29 1979

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	15	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	1.70	0.0	1.70	0.80	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	23.80	113.00	123.00	132.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.50	0.10	0.0	0.0

GIVEN UNIT GRAPH, NUHGQ= 11

259.	917.	1164.	846.	494.	306.	176.	106.	65.	39.	
24.										

UNIT GRAPH TOTALS 4396. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.0 QRCSN= 0.0 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.03	0.00	0.
2	0.03	0.00	0.
3	0.03	0.00	0.
4	0.03	0.00	0.
5	0.03	0.00	0.
6	0.03	0.00	0.
7	0.03	0.00	0.
8	0.03	0.00	0.
9	0.03	0.00	0.
10	0.03	0.00	0.
11	0.03	0.00	0.
12	0.03	0.00	0.
13	0.03	0.00	0.

BY D.J.M. DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A10 OF.

CHKD. BY _____ DATE _____ WRIGHTSVILLE DAM PROJECT C-224

SUBJECT _____

14	0.03	0.00	0.
15	0.03	0.00	0.
16	0.03	0.00	0.
17	0.03	0.00	0.
18	0.03	0.00	0.
19	0.03	0.00	3.
20	0.03	0.00	6.
21	0.03	0.00	10.
22	0.03	0.00	12.
23	0.03	0.00	14.
24	0.03	0.00	14.
25	0.08	0.05	28.
26	0.08	0.05	75.
27	0.08	0.05	134.
28	0.08	0.05	177.
29	0.08	0.05	202.
30	0.08	0.05	218.
31	0.08	0.05	227.
32	0.08	0.05	232.
33	0.08	0.05	236.
34	0.08	0.05	238.
35	0.08	0.05	239.
36	0.08	0.05	239.
37	0.08	0.05	239.
38	0.08	0.05	239.
39	0.08	0.05	239.
40	0.08	0.05	239.
41	0.08	0.05	239.
42	0.08	0.05	239.
43	0.08	0.05	239.
44	0.08	0.05	239.
45	0.08	0.05	239.
46	0.08	0.05	239.
47	0.08	0.05	239.
48	0.08	0.05	239.
49	0.54	0.51	358.
50	0.54	0.51	778.
51	0.54	0.51	1312.
52	0.54	0.51	1700.
53	0.65	0.62	1954.
54	0.65	0.62	2193.
55	0.65	0.62	2399.
56	0.65	0.62	2539.
57	0.81	0.78	2663.
58	0.81	0.78	2862.
59	0.81	0.78	3080.
60	0.81	0.78	3228.
61	2.04	2.02	3635.
62	2.04	2.02	4823.
63	2.04	2.02	6294.
64	2.04	2.02	7358.
65	0.75	0.73	7645.
66	0.75	0.73	6846.
67	0.75	0.73	5565.
68	0.75	0.73	4604.
69	0.59	0.57	4005.
70	0.59	0.57	3510.
71	0.59	0.57	3125.
72	0.59	0.57	2852.
73	0.04	0.02	2546.
74	0.04	0.02	1943.

75	0.04	0.02	1245.
76	0.04	0.02	763.
77	0.04	0.02	482.
78	0.04	0.02	307.
79	0.04	0.02	207.
80	0.04	0.02	149.
81	0.04	0.02	113.
82	0.04	0.02	92.
83	0.04	0.02	78.
84	0.04	0.02	78.
85	0.04	0.02	78.
86	0.04	0.02	78.
87	0.04	0.02	78.
88	0.04	0.02	78.
89	0.04	0.02	78.
90	0.04	0.02	78.
91	0.04	0.02	78.
92	0.04	0.02	78.
93	0.04	0.02	78.
94	0.04	0.02	78.
95	0.04	0.02	78.
96	0.04	0.02	78.
97	0.0	0.0	74.
98	0.0	0.0	57.
99	0.0	0.0	37.
100	0.0	0.0	22.
SUM	25.12	22.60	99629.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7645.	3695.	1038.	996.	99630.
INCHES		20.22	22.72	22.72	22.72
AC-FT		1833.	2060.	2060.	2060.

RUNOFF MULTIPLIED BY 0.50

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	3.
5.	6.	7.	7.	14.	38.	67.	89.	101.	109.
113.	116.	118.	119.	119.	119.	119.	119.	119.	119.
119.	119.	119.	119.	119.	119.	119.	119.	179.	389.
656.	850.	977.	1097.	1200.	1269.	1332.	1431.	1540.	1614.
1817.	2411.	3147.	3679.	3822.	3423.	2783.	2302.	2002.	1755.
1562.	1426.	1277.	971.	622.	382.	241.	154.	103.	74.
57.	46.	39.	39.	39.	39.	39.	39.	39.	39.
39.	39.	39.	39.	39.	39.	37.	29.	18.	11.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3822.	1847.	519.	498.	49815.
INCHES		10.11	11.36	11.36	11.36
AC-FT		917.	1030.	1030.	1030.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
11	1	0	0	0	0	1

ROUTING DATA

BY O. J. M. DATE
CHKD. BY DATE
SUBJECT

LOUIS BERGER & ASSOCIATES INC.

WRIGHTS MILL DAM

SHEET NO. A12 OF
PROJECT C-284

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE=	0.	7.	14.	22.	29.	37.	45.	53.	61.	69.
OUTFLOW=	0.	81.	228.	419.	645.	901.	1381.	2047.	2842.	3884.

TIME	EOP STOR	AVG IN	EOP OUT
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	1.	0.
20	0.	2.	1.
21	0.	4.	1.
22	0.	6.	2.
23	0.	6.	3.
24	0.	7.	4.
25	0.	11.	5.
26	1.	26.	10.
27	2.	52.	19.
28	3.	78.	31.
29	4.	95.	45.
30	5.	105.	58.
31	6.	111.	69.
32	7.	115.	79.
33	7.	117.	91.
34	8.	118.	101.
35	8.	119.	107.
36	8.	119.	112.
37	9.	119.	114.
38	9.	119.	116.
39	9.	119.	117.
40	9.	119.	118.
41	9.	119.	119.
42	9.	119.	119.
43	9.	119.	119.
44	9.	119.	119.
45	9.	119.	119.
46	9.	119.	119.
47	9.	119.	119.
48	9.	119.	119.
49	9.	149.	130.
50	12.	284.	185.
51	18.	522.	314.

BY D.J.M DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A13 OF _____

CHKD. BY _____ DATE _____ WRIGHTS MILL DAM PROJECT C-234

SUBJECT _____

52	25.	753.	506.
53	31.	913.	709.
54	36.	1037.	872.
55	40.	1148.	1068.
56	42.	1234.	1195.
57	43.	1301.	1276.
58	45.	1381.	1357.
59	46.	1486.	1471.
60	47.	1577.	1569.
61	49.	1716.	1705.
62	53.	2114.	2087.
63	60.	2779.	2788.
64	66.	3413.	3498.
65	68.	3751.	3788.
66	67.	3623.	3598.
67	62.	3103.	3030.
68	58.	2542.	2514.
69	54.	2152.	2148.
70	51.	1879.	1890.
71	49.	1659.	1676.
72	47.	1494.	1508.
73	45.	1349.	1365.
74	42.	1122.	1179.
75	37.	797.	892.
76	31.	502.	698.
77	25.	311.	505.
78	20.	197.	365.
79	16.	129.	272.
80	13.	89.	202.
81	10.	65.	153.
82	9.	51.	117.
83	7.	43.	90.
84	7.	39.	76.
85	6.	39.	68.
86	5.	39.	62.
87	5.	39.	57.
88	5.	39.	53.
89	4.	39.	50.
90	4.	39.	48.
91	4.	39.	46.
92	4.	39.	45.
93	4.	39.	43.
94	4.	39.	43.
95	4.	39.	42.
96	4.	39.	41.
97	4.	38.	41.
98	3.	33.	39.
99	3.	24.	36.
100	3.	15.	31.
SUM			49695.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3788.	1828.	518.	497.	49695.
INCHES		10.00	11.33	11.33	11.33
AC-FT		907.	1027.	1027.	1027.

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BY D.J.M. DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A-14 OF

CHKD. BY _____ DATE _____ GILMAN LAKE DAM PROJECT E-234

SUBJECT _____

SUB-AREA RUNOFF COMPUTATION

INFLOW TO GILMAN NOT INCLUDING WRIGHTS MILL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	2.30	0.0	2.30	0.80	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	23.80	113.00	123.00	132.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.50	0.10	0.0	0.0

GIVEN UNIT GRAPH, NUHGG= 10

418.	1389.	1607.	1104.	636.	368.	201.	117.	67.	44.

UNIT GRAPH TOTALS 5951. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STRTG= 0.0 QRCSN= 0.0 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.03	0.00	0.
2	0.03	0.00	0.
3	0.03	0.00	0.
4	0.03	0.00	0.
5	0.03	0.00	0.
6	0.03	0.00	0.
7	0.03	0.00	0.
8	0.03	0.00	0.
9	0.03	0.00	0.
10	0.03	0.00	0.
11	0.03	0.00	0.
12	0.03	0.00	0.
13	0.03	0.00	0.
14	0.03	0.00	0.
15	0.03	0.00	0.
16	0.03	0.00	0.
17	0.03	0.00	0.
18	0.03	0.00	1.
19	0.03	0.00	4.
20	0.03	0.00	9.
21	0.03	0.00	14.
22	0.03	0.00	17.
23	0.03	0.00	19.
24	0.03	0.00	20.
25	0.08	0.05	42.
26	0.08	0.05	113.
27	0.08	0.05	194.
28	0.08	0.05	251.
29	0.08	0.05	283.
30	0.08	0.05	302.
31	0.08	0.05	312.
32	0.08	0.05	318.
33	0.08	0.05	321.
34	0.08	0.05	323.

BY D.J.M DATE

CHKD. BY DATE

SUBJECT

LOUIS BERGER & ASSOCIATES INC.

GILMAN LAKE DAM

SHEET NO. A-15 OF

PROJECT C-234

35	0.08	0.05	323.
36	0.08	0.05	323.
37	0.08	0.05	323.
38	0.08	0.05	323.
39	0.08	0.05	323.
40	0.08	0.05	323.
41	0.08	0.05	323.
42	0.08	0.05	323.
43	0.08	0.05	323.
44	0.08	0.05	323.
45	0.08	0.05	323.
46	0.08	0.05	323.
47	0.08	0.05	323.
48	0.08	0.05	323.
49	0.54	0.51	515.
50	0.54	0.51	1152.
51	0.54	0.51	1889.
52	0.54	0.51	2395.
53	0.65	0.62	2732.
54	0.65	0.62	3050.
55	0.65	0.62	3315.
56	0.65	0.62	3487.
57	0.81	0.78	3654.
58	0.81	0.78	3938.
59	0.81	0.78	4219.
60	0.81	0.78	4409.
61	2.04	2.02	5036.
62	2.04	2.02	6819.
63	2.04	2.02	8839.
64	2.04	2.02	10224.
65	0.75	0.73	10482.
66	0.75	0.73	9151.
67	0.75	0.73	7525.
68	0.75	0.73	6045.
69	0.59	0.57	5239.
70	0.59	0.57	4595.
71	0.59	0.57	4076.
72	0.59	0.57	3747.
73	0.04	0.02	3328.
74	0.04	0.02	2450.
75	0.04	0.02	1535.
76	0.04	0.02	911.
77	0.04	0.02	551.
78	0.04	0.02	342.
79	0.04	0.02	231.
80	0.04	0.02	167.
81	0.04	0.02	130.
82	0.04	0.02	106.
83	0.04	0.02	106.
84	0.04	0.02	106.
85	0.04	0.02	106.
86	0.04	0.02	106.
87	0.04	0.02	106.
88	0.04	0.02	106.
89	0.04	0.02	106.
90	0.04	0.02	106.
91	0.04	0.02	106.
92	0.04	0.02	106.
93	0.04	0.02	106.
94	0.04	0.02	106.
95	0.04	0.02	106.

96	0.04	0.02	106.	
97	0.0	0.0	99.	
98	0.0	0.0	74.	
99	0.0	0.0	45.	
100	0.0	0.0	26.	
SUM	25.12	22.60	134877.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10482.	5018.	1405.	1349.	134882.
INCHES		20.30	22.73	22.73	22.73
AC-FT		2490.	2788.	2788.	2788.

COMBINE HYDROGRAPHS

COMBINE INFLOW

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
11	2	0	0	0	0	1

SUM OF 2 HYDROGRAPHS AT 11

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	4.	10.
15.	19.	22.	24.	47.	122.	213.	282.	328.	359.
381.	397.	412.	424.	431.	435.	438.	440.	441.	441.
442.	442.	442.	443.	443.	443.	443.	443.	645.	1337.
2203.	2901.	3441.	3922.	4382.	4683.	4930.	5294.	5689.	5978.
6741.	8906.	11628.	13722.	14270.	12750.	10355.	8559.	7387.	6485.
5752.	5256.	4693.	3629.	2427.	1609.	1056.	707.	503.	369.
284.	223.	197.	182.	174.	168.	163.	159.	156.	154.
152.	151.	150.	149.	148.	147.	139.	113.	81.	57.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	14270.	6824.	1923.	1846.	184577.
INCHES		15.87	17.89	17.89	17.89
AC-FT		3386.	3816.	3816.	3816.

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
11	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE=	0.	14.	32.	54.	79.	107.	139.	175.	214.	0.
OUTFLOW=	0.	99.	261.	510.	786.	2031.	4101.	6710.	9759.	0.

TIME EOP STOR AVG IN EOP OUT

BY D.J.M. DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A-17 OF.

CHKD. BY _____ DATE _____ GILMAN LAKE DAM PROJECT C-23+

SUBJECT _____

1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	2.	0.
20	0.	7.	1.
21	0.	13.	3.
22	1.	17.	5.
23	1.	21.	7.
24	1.	23.	9.
25	2.	36.	13.
26	3.	85.	23.
27	6.	168.	42.
28	10.	248.	70.
29	14.	305.	104.
30	19.	344.	149.
31	23.	370.	191.
32	27.	389.	228.
33	30.	404.	262.
34	33.	418.	292.
35	36.	427.	318.
36	38.	433.	340.
37	39.	436.	359.
38	41.	439.	374.
39	42.	440.	387.
40	43.	441.	398.
41	44.	442.	406.
42	45.	442.	413.
43	45.	442.	419.
44	46.	442.	423.
45	46.	443.	427.
46	46.	443.	430.
47	47.	443.	433.
48	47.	443.	435.
49	49.	544.	456.
50	59.	991.	562.
51	81.	1770.	858.
52	105.	2552.	1924.
53	120.	3171.	2894.
54	130.	3681.	3525.
55	138.	4152.	4027.
56	144.	4532.	4455.
57	148.	4806.	4756.
58	152.	5112.	5061.
59	157.	5492.	5430.
60	162.	5834.	5776.
61	169.	6360.	6276.

62	187.	7824.	7640.
63	217.	10267.	9987.
64	248.	12675.	12389.
65	266.	13996.	13825.
66	262.	13510.	13543.
67	240.	11552.	11764.
68	213.	9457.	9703.
69	194.	7973.	8157.
70	180.	6936.	7066.
71	169.	6119.	6240.
72	160.	5503.	5609.
73	152.	4974.	5065.
74	142.	4161.	4291.
75	126.	3028.	3267.
76	111.	2018.	2266.
77	98.	1332.	1628.
78	87.	881.	1158.
79	80.	605.	810.
80	73.	436.	717.
81	66.	326.	637.
82	58.	253.	559.
83	52.	210.	488.
84	46.	189.	430.
85	42.	178.	381.
86	38.	171.	340.
87	34.	166.	306.
88	32.	161.	278.
89	29.	158.	256.
90	28.	155.	237.
91	26.	153.	221.
92	25.	151.	208.
93	24.	150.	197.
94	23.	149.	188.
95	22.	148.	180.
96	21.	148.	174.
97	21.	143.	168.
98	20.	126.	160.
99	19.	97.	148.
100	17.	69.	133.
SUM			183774.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13825.	6792.	1914.	1838.	183774.
INCHES		15.80	17.81	17.81	17.81
AC-FT		3370.	3799.	3799.	3799.

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RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	3822.	1847.	519.	498.	1.70
ROUTED TO	11	3788.	1828.	518.	497.	1.70
HYDROGRAPH AT	1	10482.	5018.	1405.	1349.	2.30
2 COMBINED	11	14270.	6824.	1923.	1846.	4.00
ROUTED TO	11	13825.	6792.	1914.	1838.	4.00